

Arrow 80 Reference Manual

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1.1 Arrow 80 Features

This multiplexer is a fully featured compact 4 or 8 channel statistical multiplexer. It is supplied with a wealth of features and has been designed to be easy to use, set-up and maintain.

Features

The most significant features are:

Set-up	You can set up the multiplexer through a series of easy to use menu screens, or recall one of the four permanent factory configurations. Factory configurations can also be recalled by using the front panel buttons.
Battery Memory	A lithium battery is provided to store your configuration for up to ten years.
Test Functions	You are provided with a full set of test functions allowing easy fault finding and simple installation.
Maintenance	Both local and remote configurations are stored in each multiplexer. This allows a replacement multiplexer to be installed and automatically configured with one simple step.
Performance	Using a highly efficient proprietary protocol the multiplexer will maintain an error free link under heavy loading and extreme conditions.
Reliability	High specification low power consumption components are used throughout the design of the multiplexer to give long term reliability.
Upgrade	Four channel units can be upgraded to eight channel units using a simple to install upgrade board.

High Speed

The multiplexer's composite link can run at up to 19,200 bps with either a V.24/V.28, X.21/V.11 or V.36 interface. (V.36 will interwork with V.35 equipment.)

1.2 Units and Accessories

The multiplexer is supplied with 4 and 8 channels, in a standalone case or as a 19" rackmount unit. Kits are available to upgrade existing units. The range is:

350-4061	Four channel statistical multiplexer, standalone
350-4062	Eight channel statistical multiplexer, standalone
350-4065	Four channel statistical multiplexer, rackmount
350-4066	Eight channel statistical multiplexer, rackmount
350-4064	19 inch rack mounting conversion kit

1.3 What is a Multiplexer?

Introduction

This section is provided for the benefit of users who are not familiar with multiplexer technology. Other users may choose to omit this section and go on to Chapter 2.

A multiplexer is a device that will allow two or more data channels to be concentrated down to one channel for transmission to another multiplexer. The other multiplexer will then split the concentrated data back to the relevant number of data channels.

The high speed link between the two multiplexers is usually referred to as the 'composite link'.

Multiplexers are used when two or more devices wish to share a single communications link to a remote site. The communications link may be a conventional analogue circuit, using modems or a high speed digital link, such as BT's 'Kilostream'.

There are two types of multiplexers, described below. The Arrow 80 is a statistical multiplexer.

Time Division Multiplexer

A time division multiplexer (TDM) will take data from two or more data channels and concentrate them down the composite link. Each channel is allocated a proportion of the composite link's total capacity, equal to the channel's speed in bps. This proportion is then always available for use.

In addition to the sum of the data channel speeds, a TDM uses a proportion of the composite speed for managing the data. Therefore with a TDM the sum of the speeds of the input data channels must always be less than the total composite speed.

TDMs are normally used when synchronous data channels are required and the composite link speed is high, e.g. 64,000 bps for Kilostream. Some modern TDM's, such as the Arrow 640, will allow part of their composite link to be used for voice traffic. This effectively bypasses the need for a dedicated voice line.

Example:

Composite link speed	64,000 bps
Less 10% TDM overhead	6,400 bps
2 data channels at 9,600 bps	19,200 bps
1 voice channel	32,000 bps
Remaining Bandwidth for use	6,400 bps

Statistical Multiplexer

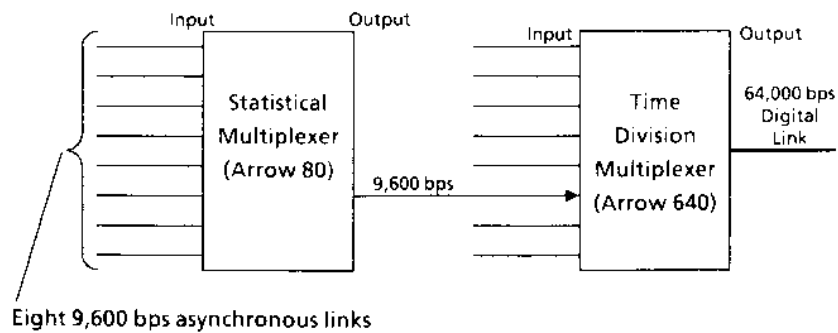
A statistical multiplexer will take data from two or more channels and concentrate them down a composite link.

Unlike a TDM a statistical multiplexer assumes that not all channels wish to transmit simultaneously, and therefore dynamically allocates the composite link to the channels that need it.

A statistical multiplexer is suited to applications where the data channels are asynchronous. It is quite normal to connect eight asynchronous devices running at 9,600 bps to a statistical multiplexer running with a composite speed of 9,600 bps.

A feature of a statistical multiplexer is that it will correct errors caused by line noise on its composite link.

It is useful to use a time divisional multiplexer to divide a high speed composite link into 9,600 bps channels, then use one or more of those channels to connect to a statistical multiplexer. A diagram showing this arrangement is given below.



2

Unpacking and Installation

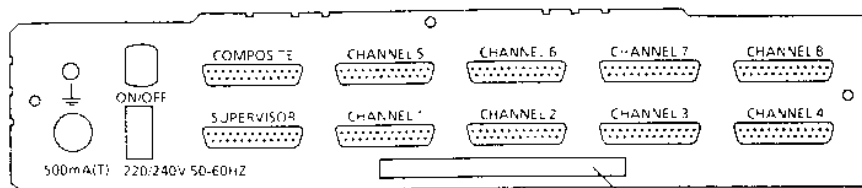
2.1 Unpacking and Siting

The equipment is packed in a container system. Please save the packing materials in case the multiplexer needs to be shipped elsewhere at any time.

Before installing your multiplexer you will need to decide on its siting. The following maximum cable lengths will help you determine this:

Composite	If this is configured as V.24/V.28 (factory default) the maximum length for this cable is 15 metres. Configured as an X.21 port this length can be increased to 1,200 metres using a suitable cable.
Data Channels	CCITT V.24/V.28 specifies a maximum cable length of 15 metres for data channels. However, in practice the distance is determined by the data speed, the quality of cable used, the level of electrical noise in the vicinity of the cable and the performance of the output circuits in the connected equipments. This multiplexer has high output drivers allowing longer cable lengths to be used. In practice, distances of up to 150 metres can be used, particularly at the lower data speeds. See Appendix B for wiring details.
Power Lead	Within 2 metres of a mains power supply.
Environment	An ideal site for a multiplexer is adjacent to the modem or digital line used for the composite link. It is also a good idea to make sure the front panel indicators can be seen easily. Please ensure the position allows adequate air circulation around the multiplexer.

2.2 Rear Panel Details



WARNING: CONNECT ONLY APPARATUS COMPLYING WITH BS6301 TO THESE PORTS UNLESS CONNECTION IS MADE TO A PUBLIC TELECOMMUNICATIONS NETWORK

Figure 2-1 Multiplexer Rear Panel

- CHANNEL 1-8** These are the multiplexer's data channel ports. The connectors are V.24 25-pin female connectors. Only equipment conforming to BS6301 should be connected to these ports. See Appendix C for details of pin allocation.
- COMPOSITE** The composite connector is used to connect the multiplexer to the high speed composite link. See Appendix B for details.
- SUPERVISOR** Used to attach a console allowing you to monitor or configure your multiplexer. Only equipment conforming to BS6301 should be connected to this port. It is terminated with a female V.24 connector. See Appendix D for wiring details.
- POWER** This is a 2 metre cord fitted with a 13 amp plug for connection to a standard UK mains socket.
- ON/OFF** This switch turns your multiplexer's mains power on or off.
- 500mA (T) Fuse** This is a mains fuse and is fitted with a 500mA 250V 20mm slow blow fuse. If you need to replace the fuse only use the correct type and disconnect the mains before proceeding.
- Connection Earth** This may be used to externally earth the multiplexer. If this is not used it is important to connect the Composite port to the external modem or digital circuit ONLY with the mains plug inserted.

2.3 Installation

To install your multiplexer please follow this procedure:

1. Ensure the composite modem or digital link between the two sites is operational.
2. If required (see Section 2.2), connect the external earth to a suitable earthing point.
3. Connect the multiplexer to the mains and switch it on.
4. Check the **ACTIVE** indicator is on. If it is off or flashing, re-check the mains supply and power switch. If it remains off or flashing, contact your supplier.
5. Connect the composite port of the multiplexer to the modem or digital circuit. See Appendix B for details of suitable cables.

With both multiplexers connected, the **CONNECT** or **MISMATCH** indicator should light. If the **MISMATCH** light is on you may wish to clear the mismatch condition before connecting the user data channels. Please see Section 3.5 for further details.

If the **CONNECT** or **MISMATCH** indicators do not light, you should first check that the multiplexer at the remote end is connected, and secondly check that the modem/digital link is operational.

6. You will now need to configure your multiplexer. You can do this by loading one of the four factory configurations from the front panel buttons, or logging on to the **SUPERVISOR** port. Details of using both these methods are described in Chapters 3 and 4.
7. Lastly connect the required devices (terminals or computers) to the user data channels. Details of the cables required are given in Appendix C.

To help you install terminals you can ask the multiplexer to locally generate a 'quick brown fox' message. The procedure for doing this is described in Section 4.7. When each terminal is connected to the multiplexer you should see the 'quick brown fox' message followed by the channel number.

If this does not happen, check that the port configuration and the settings in the terminal match and that the connecting cable is wired correctly.

2.4 Front Panel Details

The multiplexer's front panel contains 22 indicators and three push-button switches. The indicators are used to inform you of the status, and the buttons are used to load configurations.

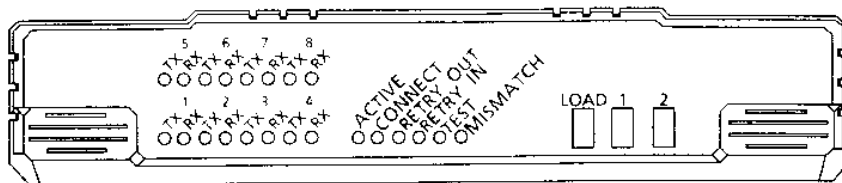


Figure 2-2 Multiplexer Front Panel

2.4.1 Indicators

- TX 1-8** Transmit data for channels 1 to 8. The indicators will flash when the multiplexer transmits data to the computer or terminal attached to that channel.
- RX 1-8** Receive data for channels 1 to 8. The indicators will flash when the multiplexer receives data from the computer or terminal attached to that channel.
- ACTIVE** This indicator has three states:
- OFF** Indicates that the multiplexer is not powered ON.
 - ON** Indicates that the multiplexer is powered ON and has passed its power diagnostics.
 - FLASHING** Indicates that the multiplexer is powered ON and a hardware error has been detected. In this case you should contact your supplier.
- CONNECT** Used to indicate that the multiplexer is connected and communicating successfully with another multiplexer through the composite link.
- RETRY OUT** Indicates that there was an error in the data transmitted to the remote multiplexer and the remote multiplexer has requested this data be re-sent.

3 Configuration and Supervisor Port

3.1 What is a Configuration?

A multiplexer configuration is a group of settings defining how different parts of the multiplexer should operate.

Four factory configurations have been provided to help you quickly configure the multiplexer to a standard setting. If your application differs slightly from this standard, then you need only modify a few settings of the active configuration. This configuration will remain stored when power is removed (for up to ten years).

Examples of the settings that are used to create a multiplexer configuration are:

- Speed and character settings for each of the data channels.
- Supervisor terminal type.
- Multiplexer name.

3.2 Factory Configurations

The multiplexer has one active configuration which is used for operation and four stored factory configurations.

All configurations have the line type set to HOST. This will disable link messages and broadcast messages being output on data channels. If you wish to change this setting for any terminal channels then you should alter their setting in the 'Speed, Data and General' section of the 'Define User Channels menu'. See Section 4.2.

Details of each configuration are as follows:

Factory Configuration 0

Speed	9,600
Bits per Character	8
Parity	None
Stop Bits	1
Line Mode	Host
Echo	No
DSR	High
CTS	High
DCD	High
Ring	Low
Mux Flow Control	XON/XOFF
User XON Flow Control	XON/XOFF
User V.24 Flow Control	None
User XON Passed Through	No

Factory Configuration 1

Speed	9,600
Bits per Character	8
Parity	None
Stop Bits	1
Line Mode	Host
Echo	No
DSR	REM
CTS	High
DCD	REM
Ring	REM
Mux Flow Control	CTS

User XON Flow Control	None
User V.24 Flow Control	DTR
User XON Passed Through	No

Factory Configuration 2

Speed	4,800
Bits per Character	7
Parity	Even
Stop Bits	1
Line Mode	Host
Echo	No
DSR	High
CTS	High
DCD	High
Ring	Low
Mux Flow Control	XON/XOFF
User XON Flow Control	XON/XOFF
User V.24 Flow Control	None
User XON Passed Through	No

Factory Configuration 3

Speed	4,800
Bits per Character	7
Parity	Even
Stop Bits	1
Line Mode	Host
Echo	No
DSR	REM
CTS	High
DCD	REM
Ring	REM
Mux Flow Control	CTS
User XON Flow Control	None
User V.24 Flow Control	DTR
User XON Passed Through	No

3.3 Loading Configurations from the Front Panel

The four factory configurations can be loaded from the front panel push-buttons during power-up, allowing for quick installation without the need to configure via a terminal.

To Load a Configuration from the Front Panel:

1. Make sure the multiplexer power is turned OFF.
2. Select your configuration by setting the buttons according to the table below.

Configuration	Button 1	Button 2
Factory Configuration 0	Out	Out
Factory Configuration 1	In	Out
Factory Configuration 2	Out	In
Factory Configuration 3	In	In

3. Then press and hold the **LOAD** button in while powering the multiplexer ON. Continue to hold the button in for at least 5 seconds.
4. The multiplexer now has the new configuration loaded and is ready for use.

3.4 Logging On to the Supervisor Port

Before you can log on to the supervisor port you will need to ensure you have the following items:

- A computer or terminal with a V.24/RS-232-C serial port capable of communicating asynchronously at 300, 1,200, 2,400, 4,800 or 9,600 bps.
- A 25-pin male D-type cable, to connect between the multiplexer's supervisor port and the computer or terminal. See Appendix D for details of the cable required.

Connections

1. Connect the cable between the computer or terminal and the port on the rear of your multiplexer labelled **SUPERVISOR**.
2. Set your computer or terminal to one of the following settings:
 - 300, 1,200, 2,400, 4,800 or 9,600 bps asynchronous full-duplex.
 - 1 start bit, 7 data bits, even parity and 1 stop bit.

You are now ready to log on to the supervisor port.

Conventions

During this section and the remainder of the manual, the following conventions are used:

Responses from the multiplexer are shown in **modern font**.

<CR> represents a carriage return character, (Hex 0D)

<ESC> represents an escape character, (Hex 1B)

Logging On

To log on to the supervisor port type:

<CR> <CR> The second <CR> must follow within 2 seconds. (Only one <CR> is required at 9,600 bps.)

The multiplexer will respond with:

Connected DD:MM:YY HH:MM Mux Id aaaaa Link xxxx vvv

where DD:MM:YY is the date
HH:MM is the time
aaaaa is the multiplexer's ID
xxxx This denotes that the link is in one of two states, either UP – the multiplexer is connected to a remote multiplexer, or DOWN – there is no connection with a remote multiplexer.
vvv is the multiplexer's software revision.

One of the following messages will then be displayed:

Please press ENTER to continue:

or

Please enter password:

The second message will only appear if you have password protected the supervisor port. (The factory default is no password.)

To continue press <CR> or key in the password. The following 'Main Menu' will then be displayed.

```

                                     Statistical Multiplexer
                                     Main Menu
1      Display Channel Configurations
2      Define User Channels
3      Define Console Parameters
4      Restore Factory Configurations
5      Set Date and Time
6      Message Control
7      Test and Diagnostic Functions
8      Define Composite Interface

X      To Leave Console Mode

Please enter your selection:
```

See Chapter 4 of this manual for details of the 'Main Menu' options.

3.5 Configuration Mismatch

An important feature of the multiplexer is its ability to store both local and remote channel configurations in each multiplexer. This allows you to set up channel configurations from either end and download configurations from one unit to another.

With two multiplexers running, the data channel configurations in the local and remote units will be identical. If a change is made with the link between the two multiplexers active, both multiplexers' configurations are updated at the same time.

A configuration mismatch means that the configurations held in both multiplexers are not identical.

A configuration mismatch occurs when changes are made to a configuration without the other multiplexer connected. A mismatch may also occur when two multiplexers are connected for the first time, or when a factory configuration is loaded.

When a configuration mismatch occurs, the **MISMATCH** indicator on the front panel will light and operation cannot continue until you tell the multiplexer which is the correct configuration to use.

There are two ways of setting the correct configuration:

- **Clearing a mismatch from the supervisor port.**

When you log on to the supervisor port and a mismatch condition exists, the following message will appear at the bottom of the Main Menu.

```
WARNING CONFIGURATION MISMATCH use Local or Remote  
Configuration (L/R)?
```

If the local configuration is the correct one press **L** and the remote multiplexer will be immediately updated and reset. If the remote configuration is the correct one press **R** and the local multiplexer will be immediately updated and reset.

- **Clearing a mismatch from the front panel push-buttons.**

Configurations can be uploaded between multiplexers after a mismatch has occurred by using the front panel buttons. To achieve this you have to select the correct configuration using the buttons labelled **1** and **2** (see table below) and then press the **LOAD** button to upload or download the configuration.

Correct Configuration	Button 1	Button 2
LOCAL configuration	Out	Out
REMOTE configuration	In	In

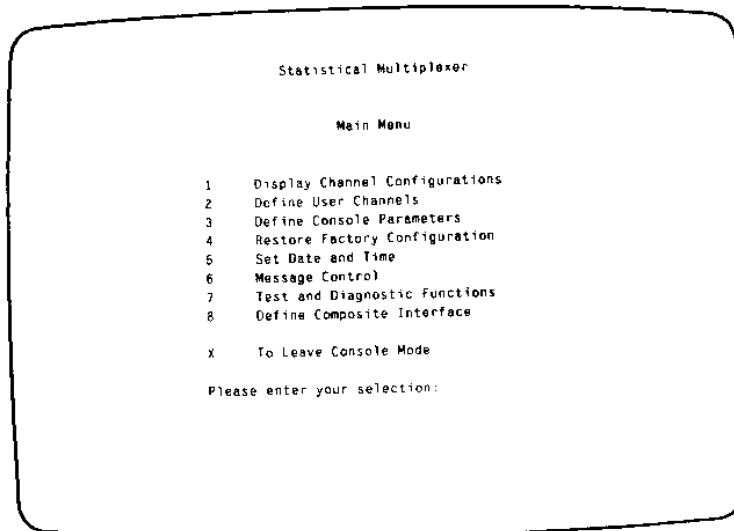
Replacing a Faulty Multiplexer

Clearing a mismatch from the front panel is particularly useful when replacing a faulty multiplexer. In the majority of cases this can be achieved without the need of logging on to the supervisor port:

1. Inform all users of the system that the link will be unavailable for a short period.
2. Power the faulty unit OFF. Remove all data and composite cables. Unplug the mains cable and external earth (if fitted).
3. Connect the external earth of the replacement unit (if required), plug in the mains and power ON.
4. Replace the composite cable and check for the **MISMATCH** indicator. If this does not light check the composite connections and retry.
5. Push in both buttons labelled 1 and 2 and then press the **LOAD** button for about two seconds.
6. Release buttons labelled 1 and 2 and check the **CONNECT** indicator is on.
7. Connect the data channel cables, and inform users that the link is now operational.

Supervisor Port Main Menu Options

To use a supervisor terminal, you must log on as described in Section 3.4. At the completion of this procedure, the Main Menu, shown below, will be displayed. The following sections describe each of the options in this menu.



4.1 Display Channel Configurations

Option 1 on the main menu will display the current settings of the data channels:

Local Channels													Mux ID	Statistical Multiplexer	12:12	04/01/90
CH	TYPE	RATE	LEN	PAR	STOP	ECHO	DSR	CTS	DCD	RNG	MUX	REM	USER	TEST		
1	TERM	9600	8	N	1	NO	REM	ON	ON	OFF	XON*	XON/XOFF				
2	TERM	9600	8	N	1	NO	REM	ON	ON	OFF	XON*	XON/XOFF				
3	TERM	2400	7	E	1	NO	REM	ON	ON	OFF	BOTH	XON/XOFF				
4	TERM	4800	7	E	1	NO	REM	ON	ON	OFF	XON	XON/XOFF	YES			
5	TERM	9600	8	N	1	NO	REM	ON	ON	OFF	XON	XON/XOFF				
6	TERM	9600	8	N	1	NO	REM	ON	ON	OFF	XON	NONE				
7	TERM	9600	8	N	2	NO	REM	ON	ON	OFF	CTS	XON/XOFF				
8	TERM	9600	8	N	2	YES	REM	ON	ON	OFF	WANG	WANG				

Remote Channels													Mux ID	Statistical Multiplexer	12:12	04/01/90
CH	TYPE	RATE	LEN	PAR	STOP	ECHO	DSR	CTS	DCD	RNG	MUX	REM	USER	TEST		
1	HOST	9600	8	N	1	NO	REM	ON	ON	OFF	XON	XON/XOFF				
2	HOST	9600	8	N	1	NO	REM	ON	ON	OFF	XON	XON/XOFF				
3	HOST	2400	7	E	1	NO	REM	ON	ON	OFF	CTS	XON/XOFF				
4	HOST	4800	7	E	1	NO	REM	ON	ON	OFF	BOTH	DTR	YES			
5	HOST	9600	8	N	1	NO	REM	ON	ON	OFF	XON*	XON/XOFF				
6	HOST	9600	8	N	1	NO	REM	ON	ON	OFF	XON	PIN 11				
7	HOST	9600	8	N	2	NO	REM	ON	ON	OFF	XON	XON/XOFF				
8	HOST	9600	8	N	2	YES	REM	ON	ON	OFF	WANG	WANG				

Please press ENTER to continue

The local channel configurations are displayed first, and the remote channel configurations are displayed last.

where:

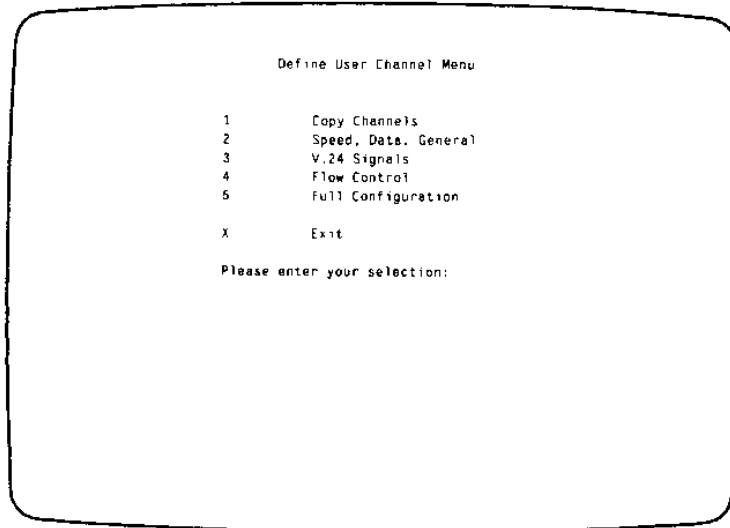
CH	is the channel number
TYPE	is whether the channel is a host or terminal port
RATE	is the speed in bits per second (bps)
LEN	is the word length excluding start, parity, and stop bits.
PAR	is the parity E=even, O=odd, N=none
STOP	is the number of stop bits
ECHO	is YES for local echo, NO for none
DSR	defines how DSR is controlled
CTS	defines how CTS is controlled
DCD	defines how DCD is controlled
RNG	defines how RING is controlled
MUX	is multiplexer flow control

REM is an * when XON characters are passed to the remote
 multiplexer
USER is user flow control
TEST indicates a test in progress on that channel

To exit the display configuration screen and return to the Main Menu,
press ENTER.

4.2 Define User Channels

To define settings for each of the data channels you will need to select option 2 from the main menu. This will bring up a secondary menu as follows:



To make life easier, we have split the configuration of data channels into three sections: speed, data and general settings, V.24 control signals, and flow control.

4.2.1 Copy Channels

To copy the configuration from one channel to another select option 1 from the 'Define User Channel Menu'. You will be prompted for:

Select Channel to Copy (1-8)?

Select and enter the channel you wish to copy from. That channel's configuration will then be displayed:

Local														
CH	TYPE	RATE	LEN	PAR	STOP	ECHO	DSR	CTS	DCD	RNG	MUX	REM	USER	TEST
1	TERM	9600	8	N	1	NO	REM	ON	ON	OFF	XON*		XON/XOFF	
Remote														
2	TERM	9600	8	N	1	NO	REM	ON	ON	OFF	XON*		XON/XOFF	

You now select the channel(s) you wish to copy the configuration to by keying in their location. Press X to finish the copy.

Copy to Channel (X to Exit) ? 1

Copy to Channel (X to Exit) ? 2

Copy to Channel (X to Exit) ? X

Copy successful – Key <CR> to return

<CR> will return you to the 'Define User Channels' menu.

4.2.2 Speed, Data and General Settings

Option 2 from the 'Define User Channel Menu' is used to configure general settings for a data channel.

Important Notes to Remember when Configuring a Port

- A <CR> is always used to accept a default entry.
- X may be used at any time to return to the 'Define User Channel Menu'.
- ? is always used to change a value from its default setting.

The multiplexer will make intelligent guesses at how you want to configure a port. For instance if you change the local parity to even, it will change your remote parity to even. This will not stop you from changing it back to another setting, and is done purely to help speed up configuration.

On selecting option 2, your multiplexer will prompt you for the channel you wish to configure:

Please Select Channel (1-8) ? 1

<CR> Accepts Default. ? to Change. X to Exit.

Below is a list of the settings available in the order they appear:

```
Local>      Speed [9600]:
Remote>     Speed [9600]:
Local>      Bits per Character [8]:
Remote>     Bits per Character [8]:
Local>      Parity [None]:
Remote>     Parity [None]:
Local>      Stop Bits [1]:
Remote>     Stop Bits [1]:
Local>      Line Mode [Host]:
Remote>     Line Mode [Term]:
Local>      Echo [No]:
Remote>     Echo [No]:
```

Should you wish to change any of the settings for these entries you will need to press ?. This will give you a list of the values and settings you may change to.

Speed. The speed of the data channel in bps. You may have different speeds at the remote and local ends, however you must make sure your flow control settings are adequate for this. Pressing ? will produce this list:

```
1      1200 Tx 75 Rx
2      1200 Rx 75 Tx
3      50
4      110
5      300
6      600
7      1200
8      2400
9      4800
10     7200
11     9600
```

Bits per character. This selects the number of data bits per character, excluding start, parity and stop bits. As a general rule it is a good idea to keep these the same on both the local and remote ends. The choices for data bits are:

- 1 5 Data bits
- 2 6 Data bits
- 3 7 Data bits
- 4 8 Data bits

Parity. Parity is stripped off by the multiplexer before data is transmitted, and added back again at the receiving end. Again as a general rule it is a good idea to keep these settings the same at both the local and remote ends. The choices are:

- 1 No Parity
- 2 Even Parity
- 3 Odd Parity

Stop Bits. This selects the number of stop bits for each character, the choices are:

- 1 1 Stop Bit
- 2 1.5 Stop Bits
- 3 2 Stop Bits

Line Mode. Identifies a channel as a host port or a terminal port. Host defines that the channel is connected to a computer, and terminal defines that it is connected to a terminal.

Messages sent from the multiplexer to the user data channels are only broadcast to the terminal ports.

Wang flow control uses the Term/Host label to automatically determine flow control direction.

Choices available are:

- 1 Term Port
- 2 Host Port

Echo. Tells your multiplexer whether to locally echo characters received back to the computer or terminal before transmission to the remote multiplexer. Choices are:

- 1 Echo from Mux Disabled
- 2 Echo from Mux Enabled

4.2.3 V.24 Signals

On the multiplexer there are four V.24 output pins for each data channel which can be controlled from four V.24 input pins on the corresponding port of the remote multiplexer. These pins are:

Controlling Pin (Input Signal to Mux)		Controlled Pin (Output signal from Mux)	
No	Pin	No	Pin
4	RTS	8	DCD
20	DTR	6	DSR
11	Unassigned	5	CTS
25	BUSY	22	RNG

Each of the output pins can be set to follow the corresponding input pin on the remote multiplexer, or to be permanently high or low.

Selecting option 3 from the Define User Channel Menu will take you through the following prompts:

```
Local >      DSR control [HIGH];
Remote >     DSR control [FROM DISTANT MUX];
Local >      CTS control [FROM DISTANT MUX];
Remote >     CTS control [LOW];
Local >      DCD control [FROM DISTANT MUX];
Remote >     DCD control [HIGH];
Local >      RING control [HIGH];
Remote >     RING control [FROM DISTANT MUX];
```

To change any of these values press ?. A menu similar to that shown below will be displayed. The first line shows the item selected and its current state. The next four lines are just a reminder of the connection between input and output signals.

The next three lines show the options available. Options 1 and 2 cause the output to be held in a fixed state, regardless of the condition of the corresponding input signal. The exception to this is when CTS is used for Multiplexer Flow Control; it must be set HIGH here, but is then switched by the flow control mechanism.

```

Locs1>   DSR           Control {HIGH}

RTS -----> DCD
DTR -----> DSR
PIN 11 -----> CTS
BUSY -----> RING

1      LOW
2      HIGH
3      From Distant (DTR) (Pin 11) (RTS) (BUSY)

<CR> Accept default
X      Exit

Please Enter Selection:

```

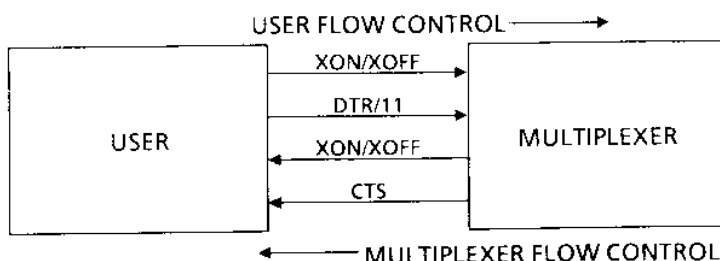
4.2.4 Flow Control

Flow control is very important on a statistical multiplexer, and if not set correctly will cause a channel to lose data. There are two types of flow control:

- Multiplexer flow control. This is the method your multiplexer uses to stop the attached computer or terminal transmitting data. It will signal a stop sequence when its buffer becomes 80% full, and will send a start sequence when it empties below 40%. It can take two forms:
 - XON/XOFF Flow Control. A specific character is used to stop data, and another character to restart data. These characters are known as XOFF and XON and are Hex (11) and Hex (13) respectively.
 - V.24 Flow Control. A pin on the V.24 interface of the channel is turned off to stop data, and turned on to start data. This pin is known as CTS (Clear to send, pin no 5).

There is also a special type of flow control known as Wang flow control. This applies to Wang 2200 computers; for further information on this see Appendix E.

- User flow control. This is the method your computer or terminal attached to the channel uses to stop receiving data from the multiplexer. Like multiplexer flow control this can take two forms: either the XOFF/XON sequence or a V.24 pin. Pin 20 (Data Terminal Ready) or pin 11 (unassigned) may be chosen. Wang user flow control is also available and is defined in Appendix E.



Selecting option 4 from the Define User Channel Menu will take you through the following prompts:

```

Please Select Channel (1-8) ? 1
<CR> Accepts Default. ? to Change. X to Exit.
Local > Mux Flow Control [XON/XOFF]:
Remote > Mux Flow Control [CTS]:
Local > User XON/XOFF Flow Control [XON/XOFF]:
Remote > User XON/XOFF Flow Control [ANY/XOFF]:
Local > User V.24 Flow Control [DTR]:
Remote > User V.24 Flow Control [Pin 11]:
Local > User XON Passed to Remote [NO]:
Remote > User XON Passed to Remote [YES]:
  
```

If you need to change any of the default settings you will need to press ?. This will give you a list of the options you can select.

Multiplexer Flow Control. Options displayed for multiplexer flow control are:

- 1 XON/XOFF Flow Control
- 2 CTS Flow Control
- 3 Both XON/XOFF and CTS
- 4 Wang Flow Control
- 5 Both Wang Flow Control and CTS

Note that if you select options 2, 3 or 5 you must ensure CTS is set to HIGH (ON) on the V.24 signal control section.

User XON/XOFF Flow Control. A specific character is used to stop data, and another character to start data. The options are:

- 1 None
- 2 ANY/XOFF
- 3 XON/XOFF
- 4 Wang

ANY/OFF is where XOFF is used to stop data, and any other character is used as an XON. This is only used in certain special applications. Only select this option, if you are sure your application requires it.

User V.24 Flow Control. User flow control can also take the form of a V.24 (RS-232) signal. There are two pins available for this: Pin 20 (DTR) and Pin 11 (Unassigned). You can select V.24 flow control with or without user XON/XOFF flow control. The options are:

- 1 None
- 2 DTR
- 3 Pin 11

User XONs Passed to Remote. With User XON/XOFF flow control selected the multiplexer stops sending to the user immediately it receives an XOFF code. The XOFF code is then discarded and not sent to the remote multiplexer. When an XON is received this will start data again and the XON code will be discarded. At the remote end of the link the multiplexer will take care of switching off data (from the sending device) using its selected multiplexer flow control method.

However some systems like to see XONs at regular intervals as confirmation of the remote device being powered ON. The user XON passed to remote option will trap XOFFs but allow XONs to be transmitted across the link.

Please use this option if you know your system requires it.

The options are:

- 1 NO
- 2 YES

4.2.5 Full Configuration

Option 5 from the Define User Channel Menu will prompt for a full channel configuration, stepping through menu options 2, 3 and 4 in series.

4.3 Define Console Parameters

Console parameters relate to features associated with the supervisor port. Selecting option 3 from the Main Menu will take you through the following prompts:

Console Parameters

```
Console> Terminal Type [VT100]:
Console> Console Type [MODEM]:
Console> Password [12345678]:
Console> Auto Log-Off [10 mins]:
Console> Multiplexer I.D. [Head Office]:
```

If you need to change any of these values, press ? at the prompt.

Terminal Type

If you have a VT52, VT100 or VT220 terminal you may tell the multiplexer to make use of attributes for this terminal type through the supervisor port. There are also many PC programs available giving VT100 emulations. If your terminal does not have this facility then you should select TTY Mode. Options are:

```
1      VT100 Console
2      TTY Console (Dumb)
```

Console Type

The supervisor's terminal may either be directly connected to the supervisor port on the multiplexer, or connected using a modem allowing remote support. If it is connected using a modem it needs to be programmed to tell it to clear the call when the calling modem disconnects. For further information regarding the RS-232 cable required for this option See Appendix D. Options are:

```
1      Terminal (Direct Connection)
2      Terminal (Connection via Modem)
```

Supervisor Port Password

The multiplexer's supervisor port can be password protected. This eight character password will be prompted for when you log on to the supervisor port and when you wish to restore a factory configuration. If you want to enter a password, press ?.

Please Enter New Password Followed by a <CR>
(A null entry will disable the password feature)

New Password ?:

Please NOTE this password now for future reference <CR>
to continue

If you wish to disable the password feature, just press <CR> when prompted for the new password.

Auto Log-Off

Once you have logged on to the control port, a timer starts running. This timer can be set to automatically log you off the supervisor port if you have not entered any information in a set period. Options are:

- 1 Disabled
- 2 1 Minute
- 3 2 Minutes
- 4 5 Minutes
- 5 10 Minutes

Multiplexer ID

This is a 20 character ID which will appear when you log on to the supervisor port of the multiplexer, and also on top of the display configuration screen. It is useful if you access the supervisor port remotely via a switch or modem, and will help identify that you are connected to the correct unit. To set this ID, press ?.

Please Enter New Multiplexer I.D. Followed by a <CR>

New Multiplexer I.D. ?:

Please note this Multiplexer ID now for future reference <CR>
to continue

4.4 Restore Factory Configuration

The multiplexer has 4 stored configurations. These have been chosen as typical configurations allowing you to configure your multiplexer quickly. To restore a factory configuration from the supervisor port, select option 4 from the Main Menu, and follow the prompts below:

RESTORE FACTORY CONFIGURATION

Enter MUX Password :

WARNING -- THIS OPTION WILL OVERWRITE ALL USER SETTINGS

Do you wish to Proceed (Y or N)

Factory Configuration to Use (0-3):

MUX Now Running to Factory Default No [X]

MUX RESET – NOW LOGGED OFF

As soon as you select the factory configuration to use, your multiplexer will restore the configuration and log you off the supervisor port.

4.5 Set Date and Time

The multiplexer has a 24 hour clock. This is backed up by battery and only needs to be set for time changes. To change time or date select option 5 from the Main Menu, and follow the procedure:

Current Settings HH:MM – DD:MM:YY (24 Hour Clock)

Year	88?
Month	01?
Day	01?
Hours	08?
Minutes	30?

New Settings are HH:MM DD/MM/YY

Please Press ENTER to Continue:

At each entry you are prompted to enter a new value. If the value is OK pressing <CR> will take you to the next prompt. If you want to alter a value, key the correct value. Please remember to key two numbers for each value, e.g. enter 1 as 01.

4.6 Message Control

Used to broadcast a message from the supervisor port to user ports.

Messages will only be sent to ports defined as terminal ports, never to host ports. Select option 6, Message Control from the Main Menu and follow the procedure:

Message Destination Selection

- 1 Local Channels
- 2 Remote Channels
- 3 Both
- X Exit

Please Enter Selection:

Select an option from the previous menu. The operation will then continue as below:

Channel Selection

- 1 All Channels
- 2 Defined Channels
- X Exit

Please Enter Selection:

If you select defined channels you will be asked to enter the channel numbers:

- Message to Channel (X to Exit):1
- Message to Channel (X to Exit):2
- Message to Channel (X to Exit):3
- Message to Channel (X to Exit):X

Having selected all or a particular channel, you are asked to enter the message. It can be up to 57 characters long and must be terminated with a <CR>.

Note that the <CR> and <ESC> keys cannot be used within a message. If you want the message to include either of these characters use ; or * to represent them, as indicated on the menu. (This means that the symbols ; and * cannot be included in a message.)

Please Enter Message (57 Characters Max) <CR> to exit

Enter ; to represent <CR>

Enter * to represent <ESC>

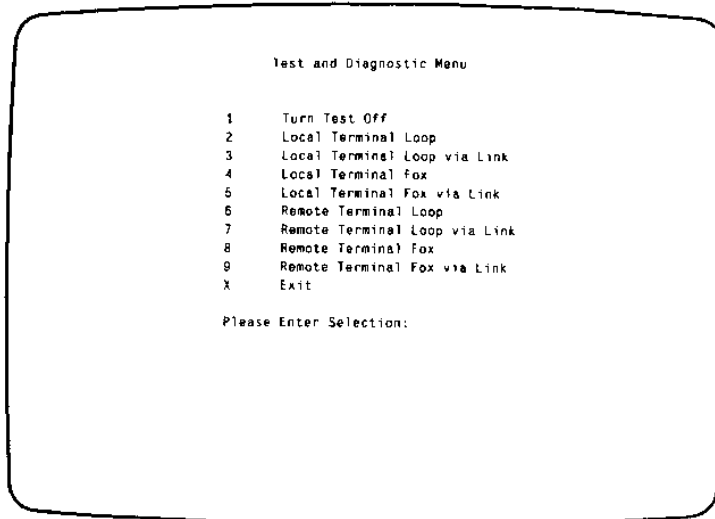
Message>This is a sample message <CR>

Enter <CR> to send message – X to Exit:

Your message will be sent immediately to all ports once you confirm it by pressing <CR> again.

4.7 Test and Diagnostic Functions

The multiplexer is equipped with a full range of test and diagnostic functions. These will help you install the multiplexer and check for problems when it is in service. There are eight tests you can perform. To access this sub-menu enter 7 from the Main Menu:



Test Options

1. Turn Test Off. Will cancel any test running on a data channel.
2. Local Terminal Loop. This option will immediately send back any characters received on that data channel. The characters are not sent to the remote multiplexer. It is a useful test for checking the cable between a terminal and the multiplexer.
3. Local Terminal Loop via Link. Characters received on a data channel are sent to the remote multiplexer on the composite link and then sent back. The characters are not transmitted to the remote data channel. This is useful for checking response times.
4. Local Terminal Fox. Will continuously send out a 'Quick Brown Fox' message to all specified local data channels. This is useful when you

install a multiplexer as you can select this option for all ports, and as soon as you connect a terminal you will see the message followed by the data channel number you are connected to.

5. Local Terminal Fox via Link. This will send each Fox message to the remote multiplexer and back before sending it to the local data channel. To indicate the message is generated across the link it is terminated by the word LINK. This test may be used for checking a suspected faulty link, i.e. the Fox message being delayed slightly while the multiplexer corrects line noise.
6. Remote Terminal Loop. Is identical to option 2 but the loop is generated on the remote multiplexer's data channel.
7. Remote Terminal Loop via Link. Identical to option 3 but the loop is generated on the remote multiplexer's data channel.
8. Remote Terminal Fox. Identical to option 4 but the Fox message is generated on the remote multiplexer's data channel.
9. Remote Terminal Fox via Link. Identical to option 5 but the Fox message is generated on the remote multiplexer's data channel.

From this menu select the required test option. You will then be asked to select the channels you wish to perform the tests on:

Select Channels to Perform Tests

Channel Number (X to Exit): 1

Channel Number (X to Exit): 2

Channel Number (X to Exit): 3

Channel Number (X to Exit): 4

Test Activated - <CR> to continue

If you select a remote test or a test via the link and the link between the local and remote multiplexer is not in operation, then you will be given the following warning message and the test request will be cancelled.

Remote Multiplexer Not Ready - Link Request Cancelled - <CR> to Return

4.8 Define Composite Interface

Select option 8 from the Main Menu to define data input through the V.24 or X.21 interface:

Composite Interface
<CR> Accepts Default. ? to Change. X to Exit

Pressing ? will produce the following:

Composite Interface Type {V.24}:

1	V.24 (RS232)
2	X.21/V.11
<CR>	Accepts Default
X	Exit

Please enter selection:

On selection of option 1 or 2 you will be given a prompt to check that link connection J9 (V.24), or J8 (X.21) is fitted. Refer to the Technical Guide.

Appendix A Technical Specification

Data Channels

No. of Channels	4 or 8 asynchronous
Speeds	50 bps to 9,600 bps plus Viewdata support
Codes	6, 7 or 8 bits per character
Stop Bits	1, 1.5 or 2 stop bits
Parity	Odd, even, none
Aggregate Input	76,800 bps
Interface	V.24/V.28 25-pin female
Flow Control	DC1/DC3, ANY/DC3, CTS, DTR, PIN 11, WANG
V.24 Control Signals	DTR/DSR, RTS/DCD, BUSY/RING, 11/CTS
Modem	Modem control lines supported

Composite Link

Composite Channel	1 synchronous
Speeds	1,200 bps to 19,200 bps (internal or external clock)
Interface	V.24/V.28, V.36, X.21/V.11
Local Connection	Up to 1,200 metres at 19,200 bps
Protocol	Proprietary HDLC based with ARQ error correction

Supervisor Port

Interface	V.24/V.28 25-pin female
Speed	Autobaud detect between 300 – 9,600 bps
Protocol	VT100 intelligent or TTY dumb

Configurations	4 stored factory configurations, 1 stored user configuration. Both local and remote configurations held in each multiplexer
Battery	Lithium with 10 year life
Modem	Modem control lines supported
Test Functions	Full local and remote test loops with Fox message
Physical	
Controls	Power switch, 3 front panel push-buttons for loading stored configurations
Channel Indicators	Tx and Rx for data on all channels
Composite Indicators	Power/Active, Connect, Retry In, Retry Out, Test, Configuration Mismatch
Dimensions	56mm high, 327mm wide, 233mm deep
Weight	2.7 kg approx.
Power	240 V (120 VAC factory-fitted option), 50-60 Hz, 8 Watts.
Enclosure	Free standing aluminium extrusion or 19 inch rack mount 2U enclosure.

Appendix B

Composite Link Cable Specifications

The multiplexer's composite port is used to connect the multiplexer to the high speed modem link or digital service. The port is a female 25-pin V.24 connector.

This port can be configured to support a V.24/V.28 interface, which is also used to connect to an X.21bis service. Using special cables it also provides V.36 or X.21/V.11 interface.

The factory configuration is V.24/V.28. To change to V.36 or X.21/V.11 you will need to configure the multiplexer (see Section 4.8) and move the composite cable connector on the base board of the multiplexer from J9 to J8 (see Appendix F). Pin assignments for the V.24 connector are as shown below:

Pin No	Name/Description	Commands	Direction
1	(GRD) Chassis Ground		
2	(TXD) Transmit Data		Out
3	(RXD) Receive Data		In
4	(RTS) Request to Send	Always High	Out
5	(CTS) Clear to Send	Monitored	In
6	(DSR) Data Set Ready	Ignored	In
7	(GND) Signal Ground		
8	(DCD) Data Carrier Detect	Monitored	In
9	(+12) 12 volt test line		Out
10	(-12) 12 volt test line		Out
11	(+5) 5 volt test line		Out
15	(TC) Transmit Clock		In
17	(RC) Receive Clock		In
20	(DTR) Data Terminal Ready	Always High	Out
24	(EXT) Ext Transmit Clock	Rate Selected by LK6	Out

Notes:

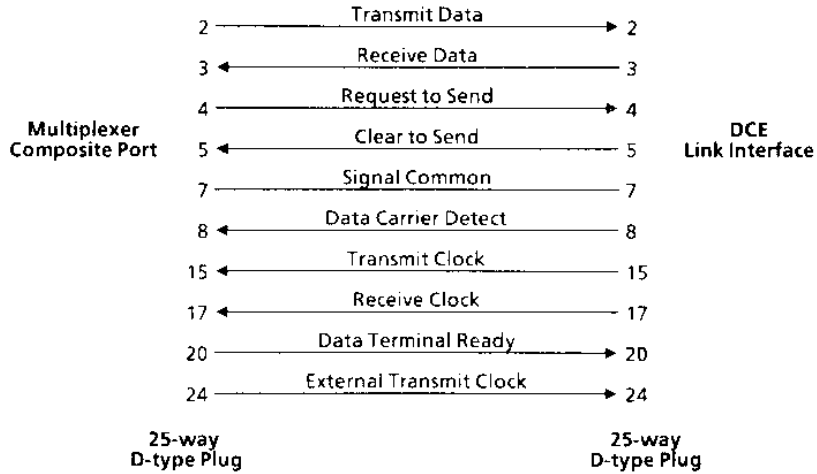
RTS and DTR are output when the multiplexer is powered on.

CTS and DCD must be high before the multiplexer will pass data.

LK6 default is 9600 bps. See Technical Guide.

V.24 Composite Interface

In most applications the communications equipment (modem or digital link) supply clocks to the multiplexer. In these cases the cable below should be used.

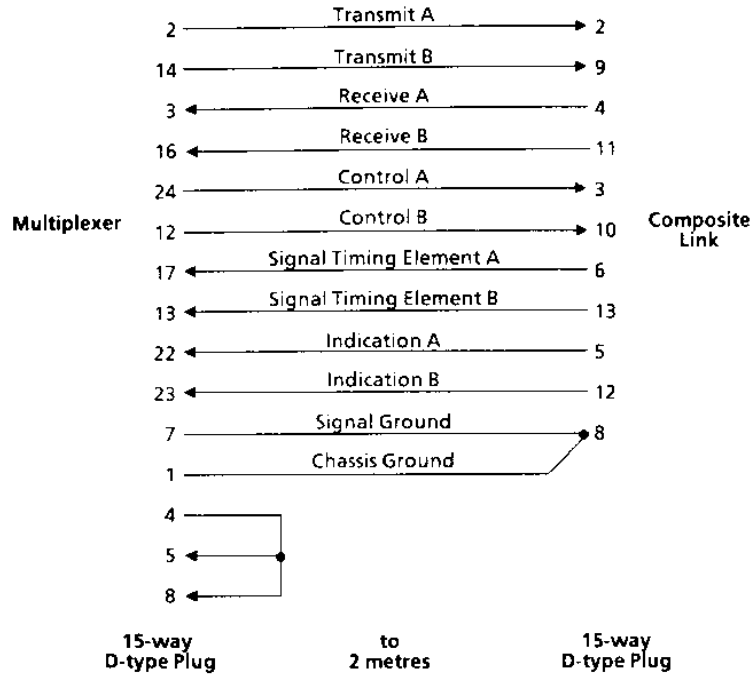


The following signals are also available at the multiplexer connector for test purposes.

- 9 + 12 volt test
- 10 -12 volt test
- 11 + 5 volt test

X.21 Composite Interface

An X.21 interface utilises a 15-pin connector. To connect between your multiplexer and an X.21 device, you will require an adapter cable as below:



Note: Belden 877 cable or equivalent.

If you need to make an extended cable the first five pairs above should be twisted pairs. The maximum cable length is 1200 metres.

The following signals are also available at the multiplexer connector for test purposes.

- 9 + 12 volt test
- 10 -12 volt test
- 11 + 5 volt test

V.35/V.36 Composite Interface

The multiplexer can also connect to equipment with a V.35 interface. (The multiplexer conforms to V.36.) If you wish to use this type of interface you will need an adapter cable as below:

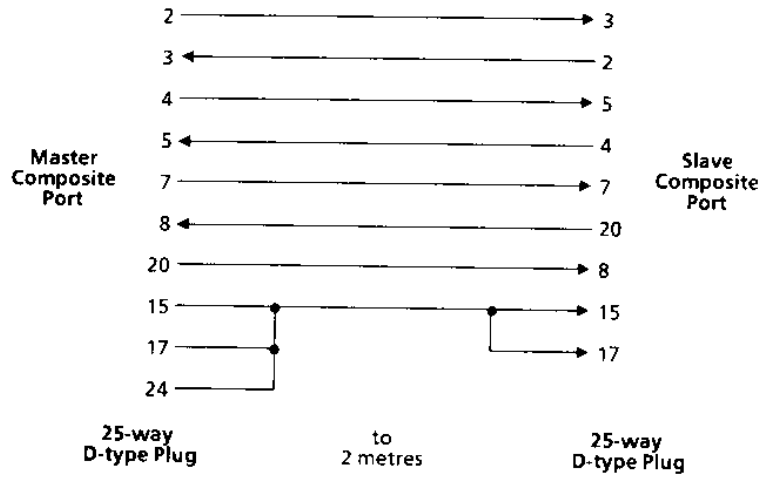
Mux Pin No	V.35 Interface Description	V.35 Pin No
2	Transmit Data A	P
14	Transmit Data B	S
3	Receive Data A	R
16	Receive Data B	T
15	Transmit Clock A	Y
19	Transmit Clock B	AA(a)
17	Receive Clock A	V
13	Receive Clock B	X
24	External Transmit Clock A	U
12	External Transmit Clock B	W
4	Request to Send	C
5	Clear to Send	D
6	Data Set Ready	E
7	Ground	B
8	Data Carrier Detect	F
20	Data Terminal Ready	H
1	Chassis Ground	-
9	+ 12 volt test line	-
10	-12 volt test line	-
11	+ 5 volt test line	-

If you wish to construct a V.35 composite interface cable please make sure the first ten connections shown above use twisted pairs.

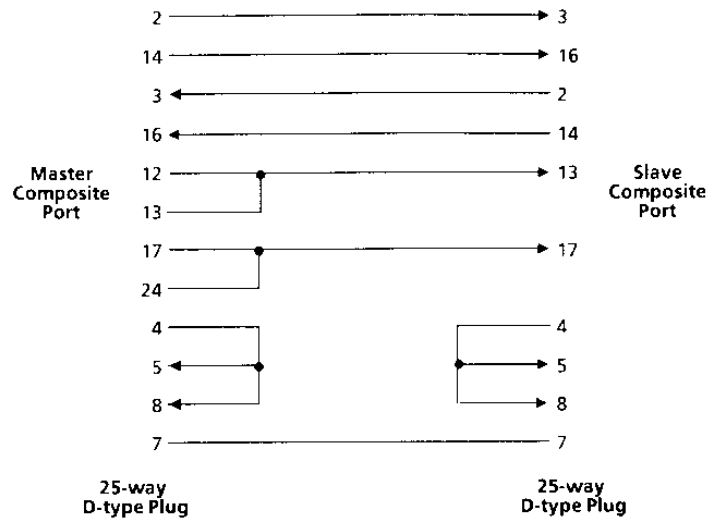
Composite Port Back-to-Back Cable

Two multiplexers may be connected back-to-back using either V.24 or X.21 interfaces. V.24 is ideal for bench testing of multiplexers. X.21 is ideal if multiplexers are to be used back-to-back at distances of up to 1200 metres. The master multiplexer should have its internal link 6 set for 9.600 bps operation (factory default). Specifications for V.24 and X.21 back-to-back cables are as follows:

V.24 back-to-back cable



X.21 back-to-back cable



Note: Belden 877 cable or equivalent.

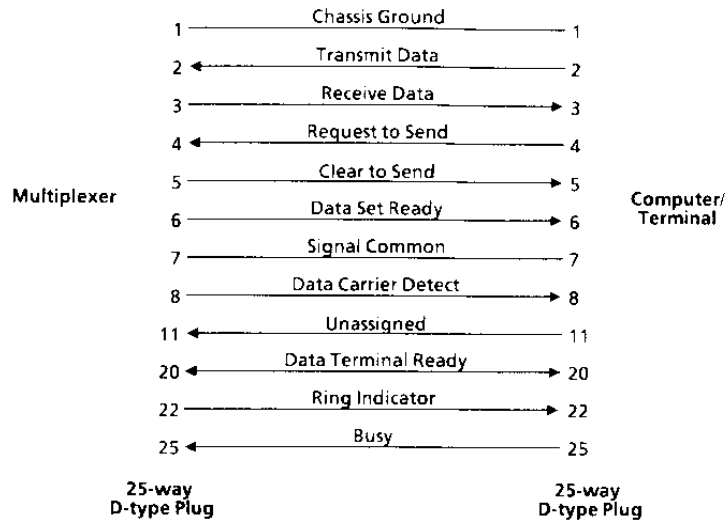
Appendix C

Data Port Cable Specifications

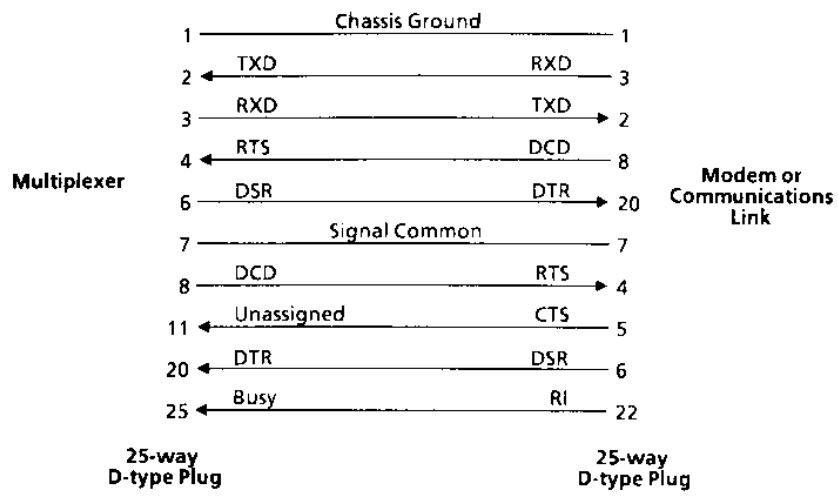
You have either 4 or 8 data channel ports. These are female 25-pin V.24, and their pin assignments are as follows:

Pin No	Name/Description	Commands	Direction
1	(GRD) Chassis Ground		
2	(TXD) Transmit Data		In
3	(RXD) Receive Data		Out
4	(RTS) Request to Send	Control Input	In
5	(CTS) Clear to Send	Controlled, F/Control	Out
6	(DSR) Data Set Ready	Controlled	Out
7	(GND) Signal Ground		
8	(DCD) Data Carrier Detect	Controlled	Out
9	(+12) 12 volt test line		Out
10	(-12) 12 volt test line		Out
11	Unassigned	Control Input F/Control	In
20	(DTR) Data Terminal Ready	Control Input F/Control	In
22	(Ring) Ring Indicator	Controlled	Out
25	(Busy) Busy	Control Input	In

The following cable specification is recommended for directly connecting user data channels to the multiplexer:



If you wish to extend user data channels with a modem or other type of asynchronous communications link to create a Tail Circuit Extension, you will need a cable wired as shown below.



Appendix D

Supervisor Port Cable Specifications

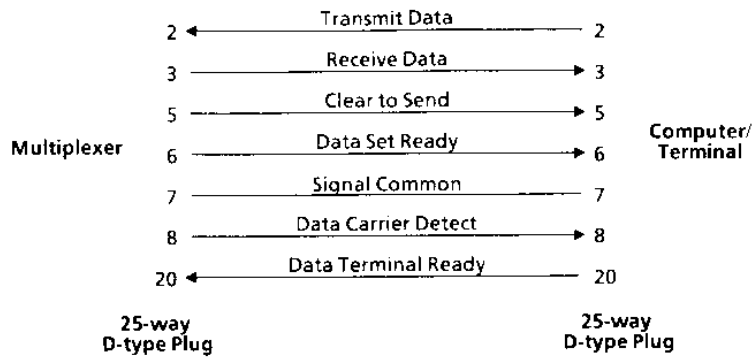
The supervisor port is terminated in a female V.24 connector, and is used to connect to any asynchronous terminal to configure the multiplexer. The port's pin assignments are shown below:

Pin No	Name/Description	Commands	Direction
1	(GRD) Chassis Ground		
2	(TXD) Transmit Data		In
3	(RXD) Receive Data		Out
5	(CTS) Clear to Send	Forced High	Out
6	(DSR) Data Set Ready	Forced High	Out
7	(GND) Signal Ground		
8	(DCD) Data Carrier Detect	*Controlled	Out
20	(DTR) Data Terminal Ready	**Monitored	In

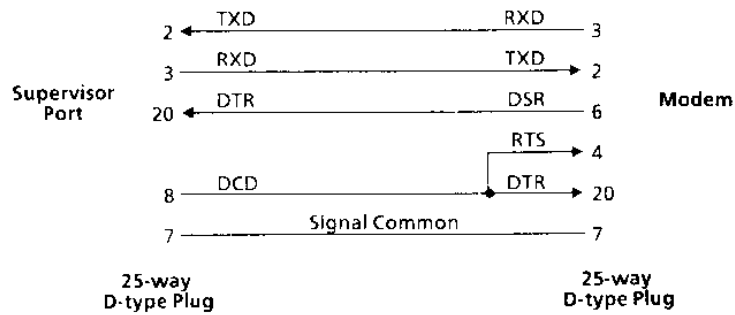
Notes:

- * When the console type is set for terminal, DCD is always turned on. When it is set for modem link, it is dropped for 2 seconds when DTR from the terminal is turned off, or when the console is logged off or times out.
- ** DTR must be on to allow you to log on to the supervisor port. If DTR is turned off while you are attached, you will be logged off.

The terminal can be local or connected via a modem link. The cable required for each situation is shown below.



If a modem is connected to the supervisor port, the cable should be:



Appendix E

Wang Flow Control Settings

The multiplexer may be configured to select Wang flow control. In addition you may configure the multiplexer using any standard Wang terminal. Below are details of these settings and supported Wang hardware:

Hardware Combinations

Hardware Type	Models Supported
CPU	2200 series MVP, LVP, SVP, Micro-VP and CS.
Multiplexer	2236MXD, 2236MXE, 22C32, 22LRS and Option W.
Terminals	2236D, 2236DE, 2236DW, 2236DE, 2336DW, 2436DW and 2436WP
PC Emulations	Wang EMUL2236 for Wang PC, Kerridge EMUL1 for Wang PC and EMUL2-3 for IBM PCs.

Flow Control Settings

To configure your multiplexer for Wang flow control follow the procedure below.

1. Set both the local and remote channels to the WANG option for multiplexer and user flow control.
2. Set the channel types to HOST for channels connected to 2200 CPUs and TERM for channels connected to 2200 terminals.
3. Ensure that the channels are configured for the correct speed and the data format is set to 8 data bits, odd parity and 1 stop bit.

Appendix F

Modem or Digital Service Definition

The modem or digital service being used for the composite link should be set to operate as given below. If you are unsure, check with the service provider.

Modem Links

Speed	1,200 – 19,200 bps synchronous
Data	Point-to-point full-duplex
CTS/DCD	Always on
Clocks	Output on Pins 15 and 17

Kilostream Connection Details

Kilostream is a high speed digital service available from British Telecom. It is available in most areas of the UK and should be considered as an alternative to analogue lines if available. The multiplexer may be directly connected to Kilostream if you specify the options below when ordering the line:

Speed	9,600 bps
X.21 or X.21bis	X.21bis
Duplex	Full-duplex
CTS/RTS	No delay
Circuit 108/1	Not enabled

To enquire regarding the availability of a Kilostream circuit please contact your local British Telecom Sales Office and ask to be connected to Special Services.

Mercury Communications

Mercury Communications Ltd offer a number of flexible digital services. For further information on these dial Mercury Customer Assistance on 0800-424 194.

WARNING

This appendix provides information for use by technically qualified personnel only.

The subjects covered are:

Setting the composite port for V.24 or X.21 (default is V.24)

Setting the external clock speed

Users should consult their supplier if they require any of the above to be changed.

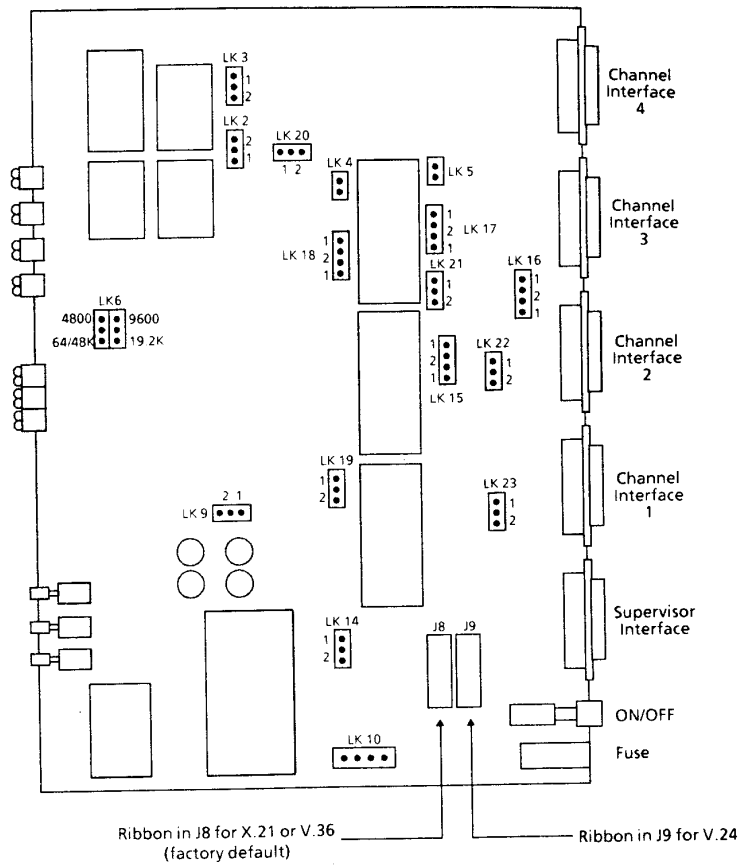


Figure G-1 Main Board

WARNING:

Do not change the position of any of the links other than LK6. The only other user change is to connect the ribbon cable to J8 or J9.

G.1 Composite Interface Connection

Your multiplexer can support an X.21, V.36 or V.24 composite interface type. Each of these requires a different cable type as described in Appendix B. However, if you are changing from, or to, a V.24 interface type you will also need to move the composite interface connector inside your unit. To achieve this follow the steps below:

1. Disconnect all cables from **CHANNEL**, **COMPOSITE** and **SUPERVISOR** connectors at the rear of the multiplexer.
2. Unplug your multiplexer from the mains supply.
3. If you have fitted an external earth connection, remove it.
4. On the rear of the multiplexer you will find seven cross-head screws attaching the rear panel to the aluminium chassis. Unscrew each of these screws. Please note there is one larger cross-head screw just above the fust holder, this must not be removed.
5. Carefully slide the rear panel/PCB assembly out of the back of the unit to expose the rear half of the PCB. Do not attempt to pull the PCB all the way out of the case.
6. You will now be able to see a short 25-way ribbon cable that connects the **COMPOSITE** connector to the bottom multiplexer circuit board. This cable can be attached to one of two possible positions on the circuit board. The one nearest the rear panel (labelled **J9**) is for V.24 interfaces. The one nearer the front panel (labelled **J8**) is for X.21 or V.36 interface types.

Composite Connector Position	Interface Type
J8	X.21 – V.36
J9	V.24 only

7. To change this connection, carefully grip the connector and lift it and the ribbon cable away. You may have to use a slight side-to-side motion before it will release. Now reconnect the cable to its new position (while supporting the underside of the circuit board).
8. Link LK6 on the main board sets the clock speed when an external clock is required by the device connected to the Composite port.
The speeds available are 19.2K, 9600 and 4800 bps. Set the link as shown on the Main Board diagram.

9. When you have finished, carefully slide the circuit board and rear panel back into its chassis. Note the front panel bezel has cutouts that allow the three front panel pushbuttons to protrude.
10. Now reassemble the multiplexer in the reverse order of steps 4 to 1 above. You will notice that you have two long screws and five short screws. The long screws are used on the sides.

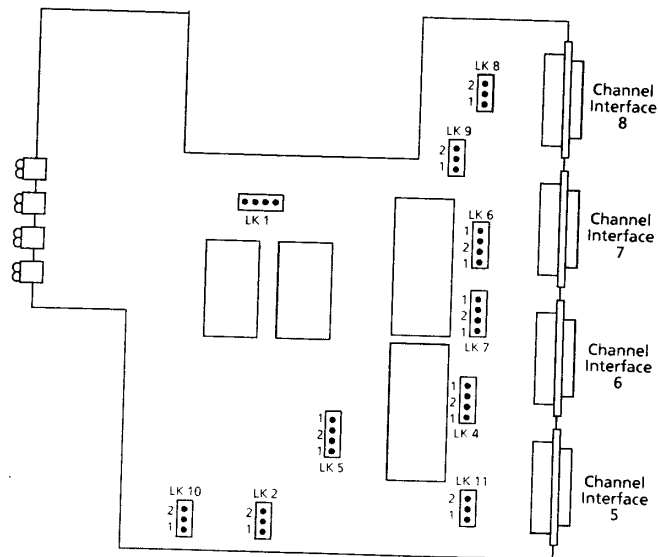


Figure G-2 Expansion Board

The board is fitted to 8 channel multiplexers.